

Development of Mathematics Learning Tools Based on Realistic Mathematical Approaches to Improve Mathematical Reasoning Ability and Mathematical Literacy Ability in Mts Negeri 2 Asahan Students

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Abstract

This research aims to: Analyzing the validity, practicality, and effectiveness of learning tools oriented towards learning based models Mathematics Based on Realistic Mathematical Approaches to Improve Mathematical Reasoning Abilities and Students' Mathematical Literacy Abilities. In trials I and II an increase in the average value of students' mathematical reasoning abilities by 14.64; 2) In trials I and II an increase in the average value of students' mathematical literacy ability of 7.29

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1. PRELIMINARY

According to Hasratuddin (2015: 27) mathematics is a means or way to find answers to problems faced by humans, a way of using information, using knowledge of shapes and sizes, using knowledge about counting, and the most important thing is to think in humans themselves to see and use relationships. In the purpose of learning mathematics, mathematical reasoning is one of the goals to be achieved^[2]. The ability of mathematical reasoning is interpreted as a way of mathematical thinking of students to determine conclusions, based on relevant sources or rules that have been verified (Mardiah: 2017)^[4]. In essence, solving a problem in mathematics requires the ability to reason, with reasoning, students are expected to see mathematics as a logical or reasonable study. Thus students believe that mathematics can be thought, understood, evaluated and proven. Based on the description above, then the conclusion drawn mathematical reasoning ability is the ability or ability of students to answer each question that is presented correctly (Ikin: 2018)^[3].

Usniawati (2011) found the cause of students failing to solve math problems, namely students lack mastering mathematical concepts with good reason. This is in line with Azriah (2018) states that Indonesia has knowledge at the level of reasoning of 17%, this shows that Indonesian students have the lowest average^[1].

In addition to mathematical reasoning ability, mathematical literacy ability is an aspect that is no less important in learning mathematics. According to the OECD (2016) mathematical literacy is the ability of students to formulate, use and interpret mathematics in various contexts^[5]. This includes mathematical reasoning and uses concepts, procedures, facts and mathematical tools to describe, explain and predict phenomena. This helps a person to recognize the role of mathematics in life and makes rational and logical judgments and decisions needed by citizens who are constructive, actively involved and reflective.

Unfortunately, the state of student ability in Indonesia is very alarming. The Ministry of Education and Culture through the Indonesian National Assessment Program (INAP) in 2016 shows that about 77.13% of elementary school students throughout Indonesia have very low mathematical competence, which is 20.58% sufficient and only 2.29% which is good category.

IFLS data (Indonesia Family Life Survey) in 2000, 2007 and 2014 representing 83% of Indonesia's population also showed mathematical emergencies. Emergency occurs because respondents who have less competence are very high in number. More than 85% of elementary school graduates, 75% of junior high school graduates, and 55% of high school graduates only reach the level of competency of students of grade 2 and below (news.okezone.com).

The low ability of mathematical reasoning and mathematical literacy ability can be influenced by several factors including learning that is monotonous, learning is dominated by smart students, teachers are less creative in designing learning devices so that children are less motivated, teachers never connect mathematics in everyday life and learning teacher centered. Responding to problems that occur in the field, namely in the process of learning mathematics in schools, especially relating to the ability of mathematical reasoning and mathematical literacy abilities, teachers must make an effort to improve the situation.

2. LITERATURE REVIEW

Efforts made include improving the quality of the learning process. Teachers are required to describe mathematics learning activities in the form of mathematical learning tools. The benefits of developing learning tools that are

carried out can be divided into two kinds of benefits for teachers and benefits for students. As according to Prastowo (2014) that the benefits of developing learning tools obtained from teachers are learning tools in accordance with curriculum requirements, not dependent on textbooks and government aid packages, while the benefits obtained by students are creating interesting learning, growing motivation, reduce dependency and get ease in learning each indicator contained in the learning tools compiled by the teacher.

But the reality on the ground is that there are still many teachers who have not designed the learning tools properly. Based on observations that have been made that the learning tools used in MTs Negeri 2 Asahan are still not in accordance with the criteria. One of them is a textbook used by teachers in learning activities. The textbooks teachers use when teaching are only textbooks provided by the school so students are rarely given questions to practice their abilities because of the limitations of the textbooks they have.

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In connection with the problems that have been described, the effort to increase students' interest in learning mathematics is a necessity that is urgent to be examined immediately in order to create a better change. Mathematical learning approaches are needed to treat mathematical reasoning problems and mathematical literacy of students, while what is meant by researchers is a realistic mathematics approach (PMR).

Realistic mathematics learning model (PMR) has been widely used in developed countries to improve their mathematical abilities. The International Journal of Education and Information Studies which shows PMR is successful in learning mathematics in junior high schools is 'The Application of Realistic Mathematics Education Approach In Teaching Mathematics in Penfui Kupang' by Tahmir. Tahmir et al (2015: 42) concluded that 'With a realistic approach to mathematics teachers, it can change the habit from the original role in which the teacher is considered as a speaker or the giver of information but now it has been changed as facilitators and mediators which are active and creative in enhancing students' learning activities^[6]. The meaning is in realistic mathematics learning, students play an active and creative role in learning, The teacher only acts as a facilitator and mediator in learning. In the International journal entitled 'The Effect of Realistic Mathematic Education on Students' Conceptual Understanding of Linear Programming' by Iksan in Malaysia also showed that the PMR model was successfully used in learning mathematics.

Based on the explanation that has been described above, the researcher felt the need to research on "Development of Mathematics Learning Tools Based on Realistic Mathematical Approaches to Improve Mathematical Reasoning Ability and Mathematical Literacy Ability of MTs Negeri 2 Asahan Students".

3. RESEARCH METHOD

This research is a research and development study. Because researchers want to develop learning tools, the learning tools developed in this study are teacher books, student books, worksheets, and lesson plans based on a realistic mathematical approach. Thus the product of this research is a mathematical learning device on the material of geometry transformation based on a realistic mathematical approach that is valid, practical, and effective.

The development of learning tools in this study refers to the ADDIE development model. The ADDIE model, as the name implies, consists of five main stages, namely (A) analysis, (D) esign, (D) e-development, (I) implementation, and (E) valuation. The five stages in the ADDIE model need to be done systematically.

4. RESULTS

Development of learning tools adapted to a realistic mathematical approach that aims to analyze the increase in mathematical reasoning ability of grade IX students of MTs Negeri 2 Asahan, analyze the increase in mathematical literacy skills of grade IX students of MTs Negeri 2, find effective learning devices to the reasoning abilities of class IX students of MTs Negeri 2 Asahan, found an effective learning tool on the mathematics literacy ability of grade IX students of MTs Negeri 2 Asahan, analyzed the differences in students' mathematical reasoning abilities between students who were given learning based on realistic mathematical approaches and ordinary learning at MTs Negeri 2 Asahan, and analyze differences in students' mathematical literacy skills between students who are given learning based on a realistic mathematical approach and ordinary learning in MTs Negeri 2 Asahan.

Based on the results of the validator's research, mathematical learning tools with a realistic mathematical approach are stated to be very valid materially, construction and language as shown in table 1 below:

Table 1 Results of Validation of Learning Devices by Experts

No	Judged Object	Average Value of Total Validity	Validation Level
1	Learning Implementation Plan	4,3	Valid
2	Student Worksheet	4,4	Valid
3	Student Book	4,4	Valid
4	Teacher's Book	4.4	Valid

Furthermore, an analysis of the effectiveness of learning tools is in accordance with the effectiveness indicators, namely classical student mastery learning, achievement of learning objectives, efficient learning time and positive student responses.

Effectiveness Analysis Learning Tools With Realistic Mathematics Approach in Trial I

Classical completeness results from students' mathematical reasoning abilities in the first test posttest by 50% and classical completeness of the results of students' mathematical literacy abilities in the first test posttest 62.5%. In accordance with the completeness criteria of student learning outcomes in a classical way, which is a minimum of 85% of students who take the test of reasoning ability and mathematical literacy ability of students are able to achieve a score of 65. Thus, the results of the posttest of reasoning ability and mathematical literacy ability have not met classical completeness because they only get a percentage $\geq 50\%$ and 62.5% completeness. So it can be concluded that in Trial I the application of learning tools with the Realistic Mathematics Approach that was developed did not meet the classical achievement criteria for completeness.

Effectiveness Analysis Learning Tools with Realistic Mathematics Approach in Trial II.

Classical completeness results from students' mathematical reasoning abilities in the posttest II trial 87.5% and classical completeness of the results of students' mathematical literacy abilities at posttest II trial amounted to 90.6%. In accordance with the completeness criteria of student learning outcomes in a classical manner, ie at least 85% of students who take the test of reasoning ability and mathematical literacy ability of students are able to achieve a minimum score of 65. Thus, the posttest results of reasoning ability and mathematical literacy ability of students meet the completeness of classical. So it can be concluded that in Trial II the application of learning tools with a realistic mathematical approach that was developed had met the classical achievement criteria for completeness.

Description of Improving Mathematical Reasoning Ability and Student Mathematical Literacy

The results of the analysis of increasing students' mathematical reasoning ability in trials I and II showed that the average mathematical reasoning ability of students on the posttest results in the first trial was 65.66 increased to 80.3 in the second trial. Thus it is known that an increase in the average value of students' mathematical reasoning abilities by 14.64.

The results of the analysis of increasing students' mathematical literacy abilities in trials I and II showed that the average mathematical literacy abilities of students on the posttest results in the first trial was 69.01 increasing to 76.30 in the second trial. Thus it is known that an increase in the average value of students' mathematical literacy ability of 7.29.

Analysis of Differences in Mathematical Reasoning Ability and Realistic Mathematics of Students Between Students Given Learning Based on a Realistic Mathematics Approach and Ordinary Learning

The average value of the mathematical reasoning ability of the mathematical realistic approach class is 80.38 and the average value of the mathematical reasoning ability of ordinary learning classes is 63.53 so there is a difference of 16.85. Also obtained $t_{count} > t_{table}$ at a significance level of 5% ($6.641 > 1.998$) and has a value of $p < 0.05$ which means that H_0 is rejected so it can be concluded that the mathematical reasoning ability of students who are given learning based on realistic mathematical approaches is higher than the mathematical reasoning ability of students who are given regular learning at MTs Negeri 2 Asahan.

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